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ABSTRACT

Perinatal variables were used to predict 7-year outcome for 538 children, 32% Negro and 68% white. Mother's age, birthplace, education, occupation, marital status, neuropsychiatric status, family income, number supported, birth weight, one- and five-minute Apgar scores were regressed on 7-year Verbal, Performance and Full Scale IQ, Bender, Wide Range Reading, Arithmetic and Spelling, ITPA Auditory Vocal Association, and Draw-A-Man or -Woman test scores. Regressions were calculated for each race, sex, and total group. With all groups combined, perinatal variables correlated significantly with all 7-year tests except Draw-A-Man, -Woman. Although not all 7-year test scores were predicted significantly for the total group, nor was any test predicted for all subgroups, the Bender test was significantly predicted for seven of the nine groups. (Author/CK)

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Perinatal variables were used to predict 7-year outcome for 538 children, 32% Negro and 68% white. Mother's age, birthplace, education, occupation, marital status, neuropsychiatric status, family income, number supported, birth weight, one- and five-minute Apgar scores were regressed on 7-year Verbal, Performance and Full Scale IQ, Bender, Wide Range Reading, Arithmetic and Spelling, ITPA Auditory Vocal Association, and Draw-A-Man or -Woman test scores. Regressions were calculated for each race, sex, and total group. With all groups combined, perinatal variables correlated at $< .001$ level with all 7-year tests except Draw-A-Man, -Woman.

Not all 7-year test scores are predicted significantly for the total group, nor is any test predicted for all subgroups; but, if the Bender test had been significantly predicted for Negro boys and total Negro group, it would have had the distinction of being significantly predicted for all groups. However, no single perinatal variable accounted for as much as 6% of the variance in one 7-year test. Multiple correlations accounted for at most only 9% of the variance. Reasons are listed for why perinatal variables accounted for so little 7-year test variance.

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CONTRIBUTIONS OF SELECTED PERINATAL VARIABLES TO SEVEN-YEAR PSYCHOLOGICAL AND ACHIEVEMENT TEST SCORES

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Problem

The University of Oregon Medical School Child Development Study of the Collaborative Project on Cerebral Palsy, Mental Retardation and Other Neurological and Sensory Disorders of Infancy and Childhood* provided data to relate perinatal variables with 7-year test scores.

Studies of this general population have already revealed meaningful relationships of early life status with later outcome. For example, 8-month Bayley scales correlated significantly with 4-year Binet IQ's (Kangas, Butler and Goffeney, 1966) and with 7-year Wechsler IQ's, and Bender scores (Goffeney, Henderson and Butler, 1971).

For the University of Oregon Medical School study population the co-relationships of 8-month Bayley scores with 7-year IQ range between .11 and .21. The Mental and Fine Motor measurements had significant but low predictive value for girls of both races and white boys, but insignificant value for Negro boys. For the Oregon population the high significance of relationships of 8-month Bayley scores to 7-year IQ resulted partly from large Ns' and statistically significant as they were, no 8-month Bayley scale accounted for as much as 7% of either later test variance. Kangas, et al, by combining variables obtained a multiple correlation of race, sex, Bayley Mental and Bayley Fine Motor scores with Binet IQ which accounted for almost 15% of the variance.

Using the University of Minnesota population from the national study, Ireton, Thwing and Gravem (1970) found that the Bayley mental scale, the 12-month neurological rating, and family socioeconomic status showed significant relationship for both boys and girls with 4-year Stanford Binet IQ.

The significant relationships reported in these studies of 8-month to 4- and 7-year intelligence measures, contradict Bayley's (1949) results. Babson and Kangas (1969) and Babson, Henderson and Clark (1969) used the Oregon sample to demonstrate a relationship between birth weight and 4-year intelligence.

Willerman, Naylor and Myrianthopoulos (1970), using the total population of the Collaborative Study, have further demonstrated a relationship between social variables and 4-year IQ by comparing the children of white mothers and Negro mothers of mixed Negro-white marriages. Children of the white mothers scored significantly above children of the Negro mothers on the Stanford Binet test. These studies also show a relationship between perinatal and infant variables to account for less than 25% of the outcome measurement variance.

Population

Myrianthopoulos and French (1968) described the Oregon Medical School sample as below average socioeconomically and more represented by Negroes than the Portland population. The total number originally equalled 3,137. Some children expired, some moved out of the area, and about 20% did not appear for the examinations. However, Babson and Kangas (1969) found scores for a "lost" sample of 4-year-olds from this population little different

from scores for children examined. For the study reported here, subjects were included only when data for all variables were available. The usual complications of obtaining adequate data on human subjects, error in recording observations, idiosyncratic characteristics and intractability, reduced the size of the sample; and, only about half the children had reached ± 3-months of age 7 by the end of July, 1969, the cut-off date for this study. For obtaining statistically meaningful ethnic comparisons, Negro (32%) and white (68%) children only were included (N = 538).

Procedure

The design, and thus the variables selected for the Collaborative study, were determined by interdisciplinary and interinstitutional committees of specialists (Berendes, 1966). Selected from the many perinatal variables were ones which the authors of this study hypothesized would correlate highest with later outcome. They included mother's age, birthplace, education, occupation, marital status and neuropsychiatric status, family income, number supported, birth weight, and 1- and 5-minute Apgar scores.

A multiple regression program was used to evaluate the contribution of perinatal variables to 7-year Verbal, Performance, and Full Scale IQ. Bender, Wide Range Reading, Arithmetic, and Spelling Tests, ITPA Auditory Vocal Association Test, and Draw-A-Man or -Woman Test scores. This regression procedure was used separately for each group and total groups; i.e., Negro girls, Negro boys, white girls, white boys, total girls, total boys, and all race and sex groups combined. The multiple correlation significance was determined from the multiple regression analyses.

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MULTIPLE CORRELATION OF PERINATAL VARIABLES

WITH SEVEN-YEAR TESTS

Outcome Variables	Negro Girls	White Girls	Negro Boys	White Boys	Negroes	Whites	Girls	Boys	Total
°'s of Freedom	88	175	84	187	173	363	264	272	537
FSIQ	.250	.341*	.417	.300	.285	.259**	.276*	.351***	.270***
VIQ	.234	.348*	.409	.298	.308	.268**	.261	.352***	.280***
PIQ	.344	.335*	.375	.254	.259	.229	.289*	.284*	.222**
$\sqrt{\text{Bender}}$	.515**	.354*	.313	.369**	.298	.297***	.344***	.319**	.279***
Reading	.293	.414**	.431	.276	.252	.261**	.272*	.297**	.218**
Arithmetic	.261	.360*	.388	.296	.265	.262**	.240	.292*	.238***
Spelling	.318	.406**	.417	.272	.266	.268**	.250	.312**	.225**
ITPA	.343	.339*	.453	.330*	.318	.265**	.300**	.358***	.300***
D-A-P	.334	.325	.281	.269	.179	196	.279*	.233	.169

* P .05.
** P .01.
*** p .001.

Perinatal Variables

1. Mother's Highest Grade
2. Income
3. Number of People Supported
4. Birth Place
5. Occupation
6. $\sqrt{\text{Birth Weight}}$
7. $\sqrt{\text{1 Minute Apgar}}$
8. $\sqrt{\text{5 Minute Apgar}}$
9. Mother's Neuropsychiatric Disease
10. Marital Status
11. Mother's Age

Results

When all groups were combined, the selected perinatal variables correlated significantly ($< .001$) with all seven-year tests except the Draw-A-Man. In comparison with the total group, the subgroup correlations unsurprisedly were higher, but their significance was lower. Yet, not all seven-year test scores are predicted at a significant level for the total group nor is any test predicted by all subgroups. But if the Bender test scores had been significantly predicted for the Negro boys and the total Negro and the total group, it would have had the distinction of being significantly predicted in all groups.

Disregarding significance levels and attending only to correlation sizes, the selected perinatal variables appear to predict most test scores at least as well for Negro boys as for white boys, for boys as well as girls, for Negroes as well as whites, and for Negro girls as well as for white girls.

Interpretations and Conclusions

Even with the number of highly statistically significant relationships, for the total group no single perinatal variable accounted for as much as 6% of the variance in one 7-year test (Correlation Matrix not attached); multiple correlations accounted for at most only 9% of the variance for the test which correlated highest with perinatal variables. These coefficients raise the question, "Why does a prospective study designed to understand perinatal contributions to outcome account for so little variance at age 7?" Some possible explanations are:

1. The homeogenous nature of the family socio-economic educational level of this sample could spuriously minimize the coefficients. For example, the SD for Full Scale IQ was 12.37 (Mean = 95.5) as

compared with a national population SD of 15.

2. The particular variables selected may have excluded ones more highly related to 7-year intelligence aptitude and achievement. Notably excluded were genetic variables.
3. The manner of tabulating some perinatal variables may obscure relationships; e.g., neuropsychiatric disease was recorded present or absent when most conditions exist in degree. Some figures were used as normally distributed variables when they were more nominal than interval designations; e.g., birthplace, marital status.
4. Other restricted measurement units and/or inappropriate cut-off points may underestimate the actual influence of some perinatal variables.
5. Some perinatal variables may have a strong deleterious influence on development, but occur so seldom that effects of it on the group are obscured. To establish reliable relationships for infrequently occurring variables (e.g., mother's neuropsychiatric disease, extremely deviant Apgar scores) would require more cases for study, data transformation, and perhaps a different statistical analysis than regression.
6. Some examiners systematically rate children non-normal more frequently than others. Thus, examiner bias may lower the effectiveness of prediction. No quality control studies were made during the perinatal data gathering period; yet, considerable examiner bias was reported for early observations.
7. Some perinatal variables immediately threatening the neonate might not threaten life after that immediate danger is surmounted; e.g.,

the Apgar score may adequately measure neonatal vulnerability, but may minimumly predict long term neuropsychiatric, psychological development.

8. Some negative perinatal conditions may be ameliorated or corrected by normal growth, "healing" or learning.

9. Others may be minimized or corrected by intention. Subject records reflect surgical, medical, or social intervention, and assignment to special education classes.

10. Although Babson and Kangas tend to discount differences for the lost sample on outcome measures, some sample loss may result from systematic processes; such as, test avoidance by parents of disabled children or change of residence.

11. No correction was introduced for excluded expired subjects. This exclusion tends to lower coefficients. Neonates with serious threats to survival or negative outcome would much more frequently expire than healthy subjects.

12. Since IQ measures here were WISC scores, the outcome criterion for intelligence itself could be challenged. A previous study found race to be the highest "contributor" to IQ, thus lending support to this argument. Other outcome measures used could be challenged for their lack of validity; for example, does the Wide Range Achievement Test really measure reading ability.

13. Some extreme scores in either direction may be negative predictors; i.e., the relationship between the independent and the dependent variable may be curvilinear. The Babson and Kangas, the Babson,

Henderson and Clark studies support this possibility in reporting extremely low, and extremely high birth weight negatively related to IQ.

14. Errors in recording and processing data are a constant threat to the discovery of the relationships between the variables.

15. Combining groups reduces the relationship between perinatal and outcome variables.

In conclusion, many variables apparently contribute to outcome. Thus, in designing future prospective studies, considering these explanations may permit better understanding of low incidence conditions.

FOOTNOTES

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BIBLIOGRAPHY

Babson, S.G., and Kangas, J. "Preschool intelligence of undersized term infants." American Journal of Diseases of Children; May, 1969; pp. 553-557.

Babson, S.G., Henderson, N.B., and Clark, W.M., Jr. "The preschool intelligence of oversized newborns." Pediatrics, 1969, 536-538.

Bayley, N. "Consistency and variability in the growth of intelligence from birth to eighteen years." Journal of Genetic Psychology, 1949, 75, 165-196.

Berendes, Heintz W. "The structure and scope of the Collaborative Project on cerebral palsy, mental retardation and other neurological and sensory disorders of infancy and childhood" from Research Methodology and Needs in Perinatal Studies, edited by Sidney S. Chipman, Abraham N. Lillienfeld, Bernard G. Greenberg, James F. Donley, and Charles C. Thomas, Springfield, Illinois, (1966).

Goffeney, B., Henderson, N.B., and Butler, B.V. "Negro-white, male-female 8-month developmental scores compared with 7-year WISC and Bender Test scores." Child Development (in press).

Ireton, H. Thwing, E. and Gravem, H. "Infant mental development and neurological status, family socioeconomic status, and intelligence at age four." Child Development, 1970, 41, 937-945.

Kangas, J., Butler, B.V., and Goffeney, B. "Relationship between preschool intelligence, maternal intelligence and infant behavior." Compilation of Papers Presented at the Meeting of the Collaborative Study on Cerebral Palsy, Mental Retardation and Other Neurological and Sensory Disorders of Infancy and Childhood. U.S. Department of Health, Education, and Welfare - Public Health Service; March 24-25, 1966; Washington, D.C.

Myrianthopoulos, N.C., and French, K.S. "An application of the U.S. Bureau of the Census socioeconomic index to a large, diversified patient population." Social Science and Medicine, 1968, 2, pp. 283-299.

Willerman, L., Naylor, A.F. and Myrianthopoulos, N.C. "Intellectual development of children from interracial matings." Science, December, 1970, 170, 1329-1331.